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# Reinforcement of dry spun polymeric fibers by cellulose nanocrystal

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## ABSTRACT

This study presents the development of composite polymeric fibers using cellulose nanocrystals (CNCs) as reinforcements. CNCs are a class of low cost, renewable and biodegradable materials with high mechanical properties and customizable surfaces. In this study, CNCs were successfully integrated into various polymeric fibers using the method of dry spinning in efforts to improve the fibers' tensile strength and modulus. The effects of CNCs on two different polymer systems (cellulose acetate and polyvinyl alcohol) were studied. The surface morphologies, mechanical properties, and interactions between the CNCs and the polymer matrix within the fibers were investigated. The results of the characterizations show significant improvement in the tensile strength and modulus of both the cellulose acetate and polyvinyl alcohol fibers with low dosage of CNCs. The presence of CNCs increased the crystallinity of the polymer matrix. The effects of the high shear rates associated with dry spinning on the alignment and dispersion of the nanocrystals in the different systems were also studied. A micromechanical model was developed using data from both systems for the prediction of the fiber mechanical properties as a function of the alignment of the CNC rods.